VIIRS/MODIS Science Teams Meeting

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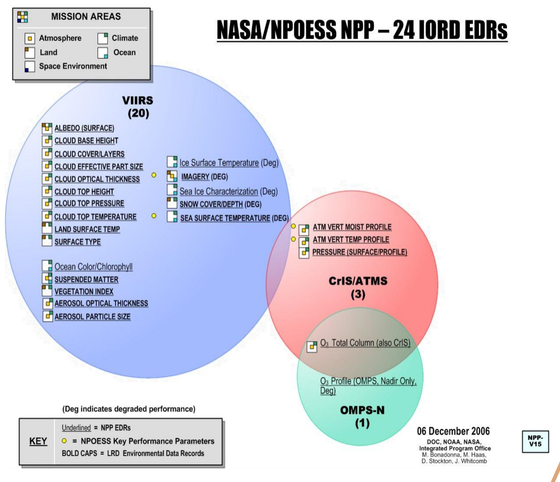
Robert J. Schweiss, NASA Goddard Space Flight Center, Code 581, Greenbelt, MD, USA

Abstract

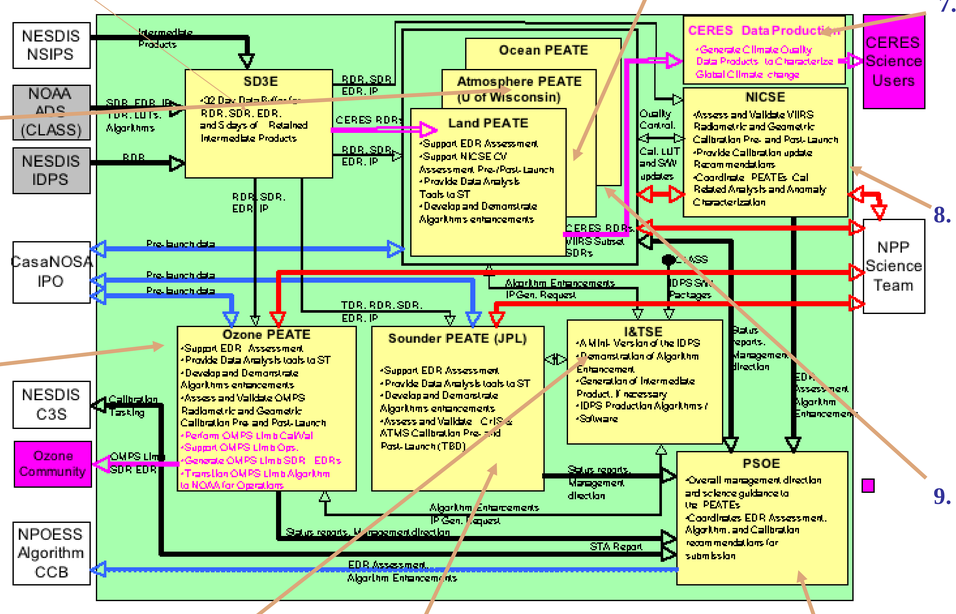
The NPP Science Data Segment (SDS) is a prototype element for future Earth Science Program distributed data systems. The SDS is intended to be a research tool that will use a fully distributed interoperable architecture, with 6 functionally independent elements organized around the following measurements: atmospheric sounding, ocean, land, ozone, earth radiance, and atmospheric composition products. The SDS will enable Climate Analysis Research Systems (CARS) development that will focus on the following areas: Atmospheric Composition, Climate Change, Carbon/Ecosystems, Solid Earth, Weather, and Water/Energy Cycle.

The primary role of the NPP SDS is limited to assessing the quality of the NPP Environmental Data Records (EDRs) for accomplishing climate research. In instances where EDRs are short of supporting climate research, algorithm enhancements can be provided and, if necessary, demonstrated to the Production Systems.



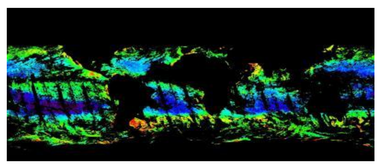
NPP SDS System Description

The SDS is composed of the following nine elements: the SDS Data Distribution and Depository Element (SD3E), the Integration and Test System Element (I&TSE), the Project Science Office Element (PSOE), the NPP Instrument Calibration Support Element (NICSE), and five Product Evaluation and Analysis Tools Elements (PEATEs), corresponding to the following disciplines: Atmosphere, Land, Ocean, Ozone, and Sounder.

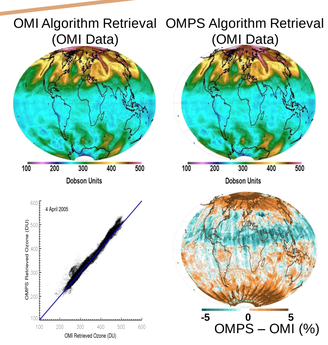


1. The SDS Data Distribution and Depository Element (SD3E) serves as a central data buffer for the five Product Evaluation and Analysis Tool Element (PEATEs) and the NICSE by receiving data from the data providers, NOAA CLASS, NSIPS, and NESDIS IDPS, checking the integrity of the data received, and staging the data for pick up by the PEATEs and/or NICSE. The centralized approached eliminates duplicative data subscriptions and transfers. The SD3E is sized to receive and stage ~219TB / day.

2. The Ocean PEATE leverages existing resources from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) Ocean Data Processing System (ODPS). EDR Evaluation process begins with analysis of onboard calibration data and vicarious calibration comparisons to the SDR. EDR evaluation includes match up analyses, residual detector (striping) and scan (RVS) dependence followed by Sensor cross-comparisons, algorithm comparisons, and any anomaly investigation. Testing and evaluation of algorithm changes requires regenerating product time series in the I&TSE and transferred back to the Ocean PEATE.

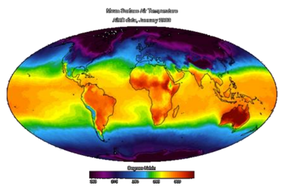


3. The Ozone PEATE assess the products with OMIDAPS, an existing system that processes data from the Ozone Monitoring Instrument (OMI) instrument aboard the Aura satellite to higher-level science data products. Ozone PEATE has the capability of running the OMPS NADIR Total Column and Profile SDR and EDR algorithms as well as heritage algorithms, e.g., V8 TC, DOAS, V7, SBUV/2 for result comparisons. It can generate and stage proxy data from SBUV/2, OMI, GOME-2. Additionally, the Ozone PEATE will ingest and manage, Ozone Total Column & Profile data and provide algorithm improvements as coordinated with the Science Team. Finally the Ozone PEATE will develop and operationalize the OMPS Limb Profiler SDR and EDR algorithms for subsequent operation by the NDE.

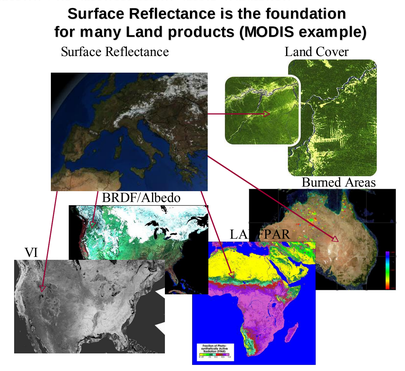


4. The Integration and Test System Element (I&TSE) provides the five SDS PEATEs, the NICSE, and the Science Team members a means of demonstrating algorithm or calibration enhancements, diagnosing science data quality anomalies, and if necessary, capability of regenerating products. The I&TSE is a smaller scale IDPS using the same IBM hardware environment as the production systems. The I&TSE interfaces with the PEATEs and NICSE to receive input data, RDR, SDR, Ancillary and Auxiliary data, LUTs, and Calibration Coefficients, and deliver output data, SDRs, EDRs, and/or Intermediate Products. The I&TSE System software version will be synchronized with the production systems.

5. The Sounder PEATE, based on the JPL AIRS TLSCF architecture, in close collaboration with the NPP Science Team, Assess the short-term and long-term quality of the Atmospheric Vertical Temperature Profile, Vertical Moisture Profile, and Vertical Pressure Profile EDRs. Additionally, Sounder PEATE performs independent analysis in support of ATMS and CrIS calibration and validation activities and can retrospectively process selected CrIMSS data with augmented versions of the CrIMSS Science code or production software. Finally, Sounder PEATE can produce gridded products, match-up & calibration subsets, and simulated products. All data are archived at the AIRS TLSCF and access, tools, and support are made available to the NPP Science Team.



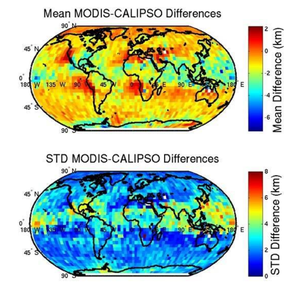
6. The Land PEATE leverages off of the Moderate Resolution Imaging Spectroradiometer (MODIS) Adaptive Processing System (MODAPS). It assesses VIIRS Land EDRs for their ability to support climate research by monitoring long-term data quality using products from other satellite instruments, ground-based products from AERONET (Aerosol Robotic Network) sites and measurements at EOS Land Validation Core sites archived in the ORNL DAAC. Specific steps in the product assessment process include: (1) Comparing gridded product produced from VIIRS EDRs with MODIS gridded science products, (2) Examining time series of summary statistics for VIIRS EDRs from 9 regions (10o x 10o) representative of the variability of MODIS land products, (3) Examining animations of global browse products to uncover anomalies and outliers that may be seasonal in nature and (4) Assisting the VIIRS ST in their analyses of EDR quality through the development of tools and assembly of ground truth and satellite measurements. Additionally, the Land PEATE assesses impacts of SDR changes on EDRs in conjunction with the VIIRS ST and NICSE



7. Earth Radiation Budget Element, leverages existing processing capabilities and human resources across the Aspheric Science Data Center (ASDC), CERES Science and Data Management groups at NASA Langley Research Center. The ASDC provides the capability to ingest, process, archive, and disseminate climate quality data products for the CERES instrument used for the characterization of Global Climate Change.

8. The NPP Instrument Calibration and Science Element (NICSE) assesses and validates pre-launch and post-launch radiometric and geometric calibration and characterization of the VIIRS instrument data. The NICSE evaluates the calibration products, and if necessary, provides recommendations for calibration software and look-up table enhancements. The NICSE works closely with the Land, Atmosphere, and Ocean PEATEs, and the NPP Science Team Members to analyze data sets, harvest calibration information, test possible calibration changes, and validate calibration recommendations.

9. The Atmospheric PEATE, leverages existing capabilities and scientific expertise at the Space Science and Engineering Center (SSEC), University of Wisconsin-Madison. It will assess the quality of NPP cloud and aerosol products by using MODIS/AIRS as proxy data for VIIRS/CrIS, by comparing the cloud/aerosol products with active sensor products (CALIPSO and CloudSat), and identify areas where agreement is poor for further evaluation. The PEATE will also assist the NPP Science Team in updating or enhancing cloud and aerosol algorithms and demonstrating algorithm improvements on global data over multiple months. This evaluation concept makes continual progress towards global evaluation and improvement of historical algorithms (such as for AVHRR), operational MODIS products, and NGST approaches.



10. The Project Science Office Element (PSOE) Provides science guidance to the Science Data Segment (coordination, management direction), reviews, algorithm and calibration recommendations prior to submitting them to the NPP/NPOESS Algorithm CC and coordinates, and manages instrument service requests to Mission Control from SDS PEATE Elements.

Pre Launch Activities

•Pre Launch: In the pre-launch time frame each of the five SDS Product Evaluation and Analysis Tool Elements (PEATEs) acquire, adapt and integrate science and operational Sensor Data Record (SDR) and Environmental Data Record (EDR) software into processing systems, adapt and update existing systems, perform functional testing of operational code, acquire and manage various preflight instrument characterization data sets, and support, as necessary, compatibility and functional testing. Additionally, as needed, the PEATEs support generation and review of proxy and simulated data and provide independent review of critical program information such as end user data formats.

EDR to PEATE Mapping

- Land PEATE
  1. Albedo (Surface)
  2. Land Surface Temperature
  3. Snow Cover and Depth
  4. Surface Type
  5. Active Fires
  6. Ice Surface Temperature
  7. Vegetation Index
- Ocean PEATE
  8. Ocean Color/Chlorophyll
  9. Sea Surface Temperature
- Ozone PEATE
  10. Ozone Total Column/Profile
  11. Ozone Limb Profile
- Atmosphere PEATE
  12. Suspended Matter
  13. Cloud Cover/Layers
  14. Cloud Effective Particle Size
  15. Cloud Top Height
  16. Cloud Top Pressure
  17. Cloud Top Temperature
  18. Cloud Base Height
  19. Cloud Optical Thickness
  20. Aerosol Optical Thickness
  21. Aerosol Particle Size
- Sounder PEATE
  22. Atmospheric Vertical Moisture Profile
  23. Atmospheric Vertical Temperature Profile
  24. Atmospheric Vertical Pressure Profile

Post Launch Activities

•Post Launch: During the post launch phase, nominally, each PEATE acquires respective RDR, SDR, & EDR, data sets of interest via the SD3E from the NESDIS Interface Data Processing System (IDPS) or NOAA CLASS. After integrity verification data is then cataloged and archived. Next the data is validated against ground-base or in situ measurements. On-orbit instrument performance and calibration are assessed (e.g. detector striping). Select RDRs are processed to SDRs & EDRs using adapted or wrapped production software with alternative calibration parameters, and SDRs are processed to EDRs using revised or alternative algorithms. The production EDRs and the locally generated EDRs are made available internally to respective Science Team members for further analysis including, Cross-Comparison with concurrent observations, comparison with past data sets from other missions, assessments of internal consistencies and effect of flagging and masking algorithms.